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SARS-CoV-2 and influenza virus co-infection

Since December, 2019, coronavirus disease 2019 (COVID-19) has been an international public health emergency.¹⁻³ Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) mimics the influenza virus regarding clinical presentation, transmission mechanism, and seasonal coincidence.³ Thus, co-infection by both viruses is feasible. To the best of our knowledge, only one case of co-infection is known, although the diagnosis was sequential.⁴ Here, we present four cases of SARS-CoV-2 and influenza co-infection, diagnosed simultaneously.

Patients 1-3 were men aged 53, 78, and 56 years, respectively, and patient 4 was a woman aged 81 years (table). All four patients had a medical history of hypertension. Patients 1 and 4 had a history of end-stage kidney disease on haemodialysis, and patients 2 and 4 had type 2 diabetes. All four patients attended the emergency department because of non-productive cough, fever, and dyspnoea for 3 days.

Physical examination revealed tachypnoea and bronchospasm with low oxygen saturation for all patients except for patient 3, whose values were normal. Chest radiography

at admission was pathological in two patients: patient 2 had bilateral infiltrates, and patient 4 had a right bilobar pneumonia. The analytical findings are summarised in the table.

Rapid nucleic acid amplification test for influenza A was positive in patients 1 and 2. Patient 3 tested positive for both influenza A and B, and patient 4 tested positive for influenza B. Following the local diagnosis protocol for SARS-CoV-2, simultaneous RT-PCR was done and was positive for all four patients. Patient 3 was discharged after 48 h without treatment or complications. However, rapid respiratory deterioration, orotracheal intubation, and mechanical ventilation were required for patients 1, 2, and 4.

We initiated treatment with lopinavir-ritonavir 400/100 mg twice a day, oral hydroxychloroquine 200 mg twice a day (in haemodialysis patients, 100 mg twice a day), and oral oseltamivir 150 mg twice a day (in haemodialysis patients, 30 mg every 48 h). Subcutaneous interferon β -1b 8MU was added every 48 h in patients 2 and 4. Patient 1 showed clinical improvement and 72 h after admission he remained stable with minimal oxygen requirements. Patients 1 and 4 remained under mechanical ventilation 72 h after admission.

Here we highlight four cases of SARS-CoV-2 and influenza co-infection and show the implications

that such a co-infection can have. The clinical and analytical courses in these patients did not differ from those previously reported for COVID-19.⁵ However, more studies are needed to assess the effect of the SARS-CoV-2 and influenza co-infection in clinical outcomes. We call on the medical community to be aware and take COVID-19 into account as a potential diagnosis even in patients with other viral causes, especially in epidemic areas.

We declare no competing interests. EC-P and EM-M contributed equally.

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- 1 Guan W-J, Ni Z-Y, Hu Y, et al. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med* 2020; **382**: 1708-20.
- 2 Phelan AL, Katz R, Gostin LO. The novel coronavirus originating in Wuhan, China: challenges for global health governance. *JAMA* 2020; **323**: 709-10.
- 3 WHO. Coronavirus disease 2019 (COVID-19) situation report—100. April 29, 2020. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200429-sitrep-100-covid-19.pdf?sfvrsn=bbfbf3d1_6 (accessed April 30, 2020).
- 4 Wu X, Cai Y, Huang X, et al. Co-infection with SARS-CoV-2 and influenza A virus in patient with pneumonia, China. *Emerg Infect Dis* 2020; **26**.
- 5 Zhou F, Yu T, Du R, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet* 2020; **395**: 1054-62.



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| | CRP (mg/dL [<1 mg/dL]) | | | LDH (U/L [<234 U/L]) | | | Ferritin (ng/mL [20-400]) | | | D-dimer (ng/mL [<500]) | | | Lymphocyte count ($\times 10^9$ cells per L [0.9-4.5]) | | | Platelets count ($\times 10^9$ cells per L [130-400]) | | | Ultrasensitive troponin I (ng/L [<45 -2]) | | |
|-----------------------------|---------------------------|------|------|-------------------------|------|------|---------------------------|------|------|----------------------------|------|------|---|------|------|--|------|------|--|------|------|
| | 0 h | 24 h | 72 h | 0 h | 24 h | 72 h | 0 h | 24 h | 72 h | 0 h | 24 h | 72 h | 0 h | 24 h | 72 h | 0 h | 24 h | 72 h | 0 h | 24 h | 72 h |
| Patient 1 (man, 53 years) | 4.3 | 10 | 10 | NA | 191 | 209 | NA | 905 | 1203 | NA | 700 | 1300 | 0.6 | 0.4 | 0.3 | 125 | 101 | 86 | 191 | 168 | 300 |
| Patient 2 (man, 78 years) | 14.0 | 15.0 | 3.6 | 314 | 340 | 283 | NA | 162 | 235 | NA | NA | 2100 | 0.3 | 0.3 | 0.5 | 60 | 60 | 81 | NA | NA | NA |
| Patient 3 (man, 56 years) | 2.1 | 3.18 | NA | NA | NA | NA | 280 | 305 | NA | 200 | 200 | NA | 1.2 | 1.8 | NA | 199 | 205 | NA | 2.8 | 2.9 | NA |
| Patient 4 (woman, 81 years) | 1.3 | 6.1 | 9.7 | 247 | 231 | 250 | NA | NA | NA | 200 | NA | NA | 0.5 | 0.5 | 0.7 | 99 | 78 | 78 | 1748 | 648 | 836 |

Numbers in square brackets correspond to the normal laboratory values. CRP=C-reactive protein. LDH=lactate dehydrogenase. NA=not available.

Table: Analytical findings of four patients with severe acute respiratory syndrome coronavirus 2 and influenza virus co-infection